

**Clean Set of Claims**

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2. A communications system according to Claim 1 wherein:  
said LLD receive interface further includes at least one LLD status  
output;

wherein said PLD send interface further includes at least one PLD  
status input; and

further comprising at least one third communications channel  
connecting said at least one LLD status output to said at least one PLD status  
input.

3. A communications system according to Claim 1 wherein:  
said PLD further comprises a PLD receive interface including PLD  
parallel information inputs and at least one PLD control input; and

wherein said LLD further comprises an LLD send interface  
including LLD parallel information outputs and at least one LLD control output;  
and

further comprising third communications channels connecting said  
LLD information outputs to respective PLD information inputs, and at least one  
fourth communications channel connecting said at least one LLD control output  
with said at least one PLD control input so that said PLD and LLD are operable in  
a push-push configuration.

4. A communications system according to Claim 3 wherein:  
said PLD send interface and said LLD send interface are  
substantially identical; and

wherein said PLD receive interface and said LLD receive interface  
~~are mirrored to thereby define symmetrical interfaces.~~

5. A communications system according to Claim 3 wherein:  
said PLD receive interface further includes at least one PLD status  
output; and

wherein said LLD send interface further includes at least one LLD  
status input; and

further comprising at least one fifth communications channel  
connecting said at least one PLD status output to said at least one LLD status  
input.

6. A communications system according to Claim 1 wherein:  
said LLD comprises an asynchronous transfer mode (ATM) device.

7. A communications system according to Claim 1 wherein:  
said PLD comprises one of a synchronous optical network  
(SONET) device and a synchronous digital hierarchy (SDH) device.

8. A communications system according to Claim 1 wherein:  
said PLD send interface comprises a string-based framing coder for  
determining and appending a string-based framing code to each information  
symbol string of information symbol strings to be transmitted in parallel over  
respective first parallel communications channels, each string-base framing code  
being based upon at least some of the information symbols in the respective  
information symbol string; and

wherein said LLD receive interface comprises a deskewer for  
aligning received parallel information symbol strings based upon the string-based  
framing codes.

9. A communications system according to Claim 8 wherein:  
each information symbol comprises a binary bit; and  
wherein said string-based coder comprises a cyclic redundancy  
checking (CRC) coder for determining and appending CRC codes to respective  
information bit strings.

10. A communications system according to Claim 9 wherein:  
said deskewer comprises a CRC framer for framing said  
information bit strings based upon said CRC codes.

11. A communications system according to Claim 8 wherein:  
said deskewer comprises:  
a framer for framing information symbol strings based upon  
said respective string-based framing codes; and  
an aligner for aligning framed information symbol strings  
relative to one another and based upon said string-based framing codes.

12. A communications system according to Claim 11 wherein:  
each information symbol comprise a binary bit; and  
wherein said aligner comprises:  
at least one first-in-first-out (FIFO) device connected to said  
framer for buffering framed information bit strings; and  
a FIFO controller for aligning framed information bit strings  
during at least one of a writing and a reading phase of said at least one FIFO  
device and based upon said string-based framing codes.

13. A communications system according to Claim 1 wherein:  
said first parallel communications channels are provided over  
electrical conductors.

14. A communications system comprising:

a physical layer device (PLD) comprising a PLD send interface including PLD parallel information outputs, at least one PLD control output, and at least one PLD status input, a PLD receive interface including PLD parallel information inputs, at least one PLD control input, and at least one PLD status output;

a logical link layer device (LLD) comprising an LLD receive interface including LLD parallel information inputs, at least one LLD control input, at least one LLD status output, an LLD send interface including LLD parallel information outputs, at least one LLD control output, and at least one LLD status input;

first parallel communications channels connecting said PLD information outputs to respective LLD information inputs;

at least one second communications channel connecting said at least one PLD control output to said at least one LLD control input;

at least one third communications channel connected said at least one LLD status output to said at least one PLD status input;

fourth parallel communications channels connecting said LLD information outputs to respective PLD information inputs;

at least one fifth communications channel connecting said at least one LLD control output to said at least one PLD control input; and

at least one sixth communications channel connected said at least one PLD status output to said at least one LLD status input.

15. A communications system according to Claim 14 wherein:

said PLD send interface and said LLD send interface are mirrored;

and

wherein said PLD receive interface and said LLD receive interface are mirrored to thereby define symmetrical interfaces.

16. A communications system according to Claim 14 wherein:  
said LLD comprises an asynchronous transfer mode (ATM) device.

17. A communications system according to Claim 14 wherein:  
said PLD comprises one of a synchronous optical network (SONET) device and a synchronous digital hierarchy (SDH) device.

18. A communications system according to Claim 14 wherein:  
said PLD send interface comprises a string-based framing coder for determining and appending a string-based framing code to each information symbol string of information symbol strings to be transmitted in parallel over respective first parallel communications channels, each string-based framing code being based upon at least some of the information symbols in said respective information symbol string; and

wherein said LLD receive interface comprises a deskewer for aligning received parallel information symbol strings based upon said string-based framing codes.

19. A communications system according to Claim 18 wherein:  
each information symbol comprises a binary bit; and  
wherein said string-based coder comprises a cyclic redundancy checking (CRC) coder for determining and appending CRC codes to respective information bit strings.

20. A communications system according to Claim 19 wherein:  
said deskewer comprises a CRC framer for framing said information bit strings based upon said CRC codes.

21. A communications system comprising:

a physical layer device (PLD) comprising a PLD send interface including PLD parallel information outputs and at least one PLD control output;

a logical link layer device (LLD) comprising an LLD receive interface including LLD parallel information inputs and at least one LLD control input;

first parallel communications channels connecting said PLD information outputs to respective LLD information inputs;

at least one second communications channel connecting said at least one PLD control output to said at least one LLD control input;

said PLD send interface further comprising a string-based framing coder for determining and appending a string-based framing code to each information symbol string of information symbol strings to be transmitted in parallel over respective first parallel communications channels, each string-based framing code being based upon at least some of said information symbols in said respective information symbol string;

said LLD receive interface further comprising a deskewer for aligning received parallel information symbol strings based upon said string-based framing codes.

22. A communications system according to Claim 21 wherein:

said PLD send interface and said LLD send interface are substantially identical; and

wherein said PLD receive interface and said LLD receive interface are mirrored to thereby define symmetrical interfaces.

23. A communications system according to Claim 21 wherein:  
said LLD receive interface further includes at least one LLD status  
output;

wherein said PLD send interface further includes at least one PLD  
status input; and

further comprising at least one third communications channel  
connecting said at least one LLD status output to said at least one PLD status  
input.

24. A communications system according to Claim 21 wherein:  
said PLD further comprises a PLD receive interface including PLD  
parallel information inputs and at least one PLD control input; and

wherein said LLD further comprises an LLD send interface  
including LLD parallel information outputs and at least one LLD control output;  
and

further comprising fourth communications channels connecting said  
LLD information outputs to respective PLD information inputs, and at least one  
fifth communications channel connecting said at least one LLD control output  
with said at least one PLD control input so that said PLD and LLD are operable in  
a push-push configuration.

25. A communications system according to Claim 24 wherein:  
said PLD send interface and said LLD send interface are mirrored;  
and

wherein said PLD receive interface and said LLD receive interface  
~~are mirrored to thereby define symmetrical interfaces.~~

26. A communications system according to Claim 25 wherein:  
said PLD receive interface further includes at least one PLD status  
output; and

wherein said LLD send interface further includes at least one LLD  
status input; and

further comprising at least one sixth communications channel  
connecting said at least one PLD status output to said at least one LLD status  
input.

27. A communications system according to Claim 21 wherein:  
said LLD comprises an asynchronous transfer mode (ATM) device.

28. A communications system according to Claim 21 wherein:  
said PLD comprises one of a synchronous optical network  
(SONET) device and a synchronous digital hierarchy (SDH) device.

29. A method for communicating between a physical layer device  
(PLD) and a logical link device (LLD), the method comprising the steps of:

sending information signals over first parallel communications  
channels from said PLD to said LLD; and

while sending control signals over at least one second  
communications channel from said PLD to said LLD so that control signals are  
sent from said PLD to said LLD out-of-band from information signals.

30. A method according to Claim 29 wherein:

said step of sending information signals over first parallel  
communications channels comprises the steps of:

operating a PLD send interface including PLD parallel information  
outputs; and

operating an LLD receive interface including LLD parallel  
information inputs.



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31. A method according to Claim 30 wherein:  
said step of sending control signals over at least one second communications channel comprises the steps of:  
operating a PLD send interface including at least one PLD control output; and  
operating an LLD receive interface including at least one LLD control input.

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32. A method according to Claim 29 further comprising the step of:  
sending status signals over at least one third communications channel from said LLD to said PLD.

33. A method according to Claim 32 wherein:  
said step of sending status signals over at least one third communications channel comprises the steps of:  
operating a PLD send interface including at least one PLD status input; and  
operating an LLD receive interface including at least one LLD status output.

34. A method according to Claim 29 further comprising the steps of:  
sending information signals over third parallel communications channels from the LLD to the PLD; and  
while sending control signals over at least one fourth communications channel from said PLD to said LLD so that control signals are sent from said PLD to said LLD out-of-band from information signals.

35. A method according to Claim 34 wherein said step of sending information signals over third parallel communications channels comprises the steps of:

operating an LLD send interface including LLD parallel information outputs; and  
operating a PLD receive interface including PLD parallel information inputs.

36. A method according to Claim 35 wherein said step of sending control signals over at least one fourth communications channel comprises the steps of:

operating an LLD send interface including at least one LLD control output; and  
operating a PLD receive interface including at least one PLD control input.

37. A method according to Claim 29 further comprising the step of sending status signals over at least one third communications channel from the PLD to the LLD.

38. A method according to Claim 29 further comprising the step of:  
operating said PLD and LLD in a push-push configuration.

39. A method according to Claim 29 wherein:

said PLD comprises a PLD send interface and said LLD comprises an LLD send interface [substantially identical] mirrored to said PLD send interface; and

wherein said PLD comprises a PLD receive interface and said LLD comprises an LLD receive interface mirrored to said PLD receive interface thereby define symmetrical interfaces.

40. A method according to Claim 29 wherein:  
said LLD comprises an asynchronous transfer mode (ATM) device.

41. A method according to Claim 29 wherein:  
said PLD comprises one of a synchronous optical network (SONET) device and a synchronous digital hierarchy (SDH) device.

42. A method according to Claim 29 further comprising the steps of:

determining and appending a string-based framing code to each information symbol string of information symbol strings at said PLD to be transmitted in parallel over respective said first parallel communications channels, each string-based framing code being based upon at least some of said information symbols in said respective information symbol string; and

deskewing received information symbol strings at said LLD by aligning received parallel information symbol strings based upon said string-based framing codes.

43. A method according to Claim 42 wherein:  
each information symbol comprises a binary bit; and  
wherein said step of determining and appending comprises determining and appending cyclic redundancy checking (CRC) codes to respective information bit strings.

44. A method according to Claim 43 wherein:  
said step of deskewing comprises framing said information bit strings based upon said CRC codes.

45. A method according to Claim 39 wherein:  
said step of deskewing comprises the step of:  
framing information symbol strings based upon respective string-  
based framing codes; and  
aligning framed information symbol strings relative to one another  
and based upon said string-based framing codes.

46. A method according to Claim 45 wherein:  
each information symbol comprises a binary bit; and  
wherein said step of aligning comprises the steps of:  
buffering framed information bits in at least one first-in-first-  
out (FIFO) device; and  
aligning framed information bit strings during at least one of  
a writing and a reading phase of said at least one FIFO device and based upon  
said string-based framing codes.

47. A method according to Claim 29 wherein:  
said first parallel communications channels are provided over at  
least one electrical conductor.

48. A method for communicating between a physical layer device (PLD) and a logical link device (LLD), the method comprising the steps of:

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sending information signals over first parallel communications channels from said PLD to [the] said LLD, and while sending control signals over at least one second communications channel from [the] said PLD to said LLD so that control signals are sent from [the] said PLD to said LLD out-of-band from information signals;

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determining and appending a string-based framing code to each information symbol string of information symbol strings at said PLD to be transmitted in parallel over respective said first parallel communications channels, each string-based framing code being based upon at least some of said information symbols in said respective information symbol string; and

deskewing received information symbol strings at said LLD by aligning received parallel information symbol strings based upon said string-based framing codes.

49. A method according to Claim 48 wherein:

each information symbol comprises a binary bit; and

wherein said step of determining and appending comprises determining and appending cyclic redundancy checking (CRC) codes to respective information bit strings.

50. A method according to Claim 49 wherein:

said step of deskewing comprises framing said information bit strings based upon said CRC codes.

51. A method according to Claim 48 wherein:  
said step of deskewing comprises the steps of:  
framing information bit strings based upon said respective string-based framing codes; and  
aligning framed information bit strings relative to one another and based upon said string-based framing codes.

52. A method according to Claim 51 wherein:  
each information symbol comprises a binary bit; and  
wherein said step of aligning comprises the steps of:  
buffering framed information bits in at least one first-in-first-out (FIFO) device; and  
aligning framed information bit strings during at least one of a writing and a reading phase of said at least one FIFO device and based upon said string-based framing codes.

53. A method according to Claim 48 wherein:  
said steps of sending information signals over first parallel communications channels comprises the steps of:  
operating a PLD send interface including PLD parallel information outputs; and  
operating an LLD receiver interface including LLD parallel information inputs.

54. A method according to Claim 48 wherein:  
said step of sending control signals over at least one second communications channel comprises the steps of:  
operating a PLD send interface including at least one PLD control output; and  
operating an LLD receive interface including at least one LLD control input.

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55. A method according to Claim 48 further comprising:  
said step of sending status signals over at least one third  
communications channel from said LLD to said PLD.

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56. A method according to Claim 55 wherein:  
said step of sending status signals over said at least one third  
communications channel comprises the steps of:  
operating a PLD send interface including at least one PLD status  
input; and  
operating an LLD receive interface including at least one LLD  
status input.

57. A method for communicating between a physical layer device (PLD) and a logical link device (LLD), the method comprising the steps of:

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sending information signals over first parallel communications channels from said PLD to said LLD, and while sending control signals over at least one second communications channel from said PLD to said LLD so that control signals are sent from said PLD to said LLD out-of-band from information signals;

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determining and appending a string-based framing code to each information symbol string of information symbol strings at said PLD to be transmitted in parallel over respective first parallel communications channels, each string-based framing code being based upon at least some of said information symbols in said respective information symbol string;

deskewing received information symbol strings at said LLD by aligning received parallel information symbol strings based upon said string-based framing codes;

sending information signals over third parallel communications channels from said LLD to said PLD; and

while sending control signals over at least one fourth communications channel from said PLD to said LLD so that control signals are sent from said PLD to said LLD out-of-band from information signals.

58. A method according to Claim 57 wherein:

said step of sending information signals over third parallel communications channels comprises the steps of:

operating an LLD send interface including LLD parallel information outputs; and

operating a PLD receive interface including PLD parallel information inputs.



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59. A method according to Claim 58 wherein:  
said step of sending control signals over at least one fourth  
communications channel comprises the steps of:  
operating an LLD send interface including at least one LLD control  
output; and  
operating a PLD receive interface including at least one PLD  
control input.

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60. A method according to Claim 59 further comprising the step of:  
sending status signals over at least one fifth communications  
channel from said PLD to said LLD.

61. A method according to Claim 48 wherein:  
said LLD comprises an synchronous transfer mode (ATM) device.

62. A method according to Claim 48 wherein:  
said PLD comprises one of a synchronous digital network (SONET)  
device and a synchronous digital hierarchy (SDH) device.

63. A method according to Claim 48 wherein:  
said first parallel communications channels are provided over at  
least one electrical conductor.

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